

STATEMENT OF RICHARD LANGAN, DIRECTOR, UNIVERSITY OF NEW HAMPSHIRE OPEN OCEAN AQUACULTURE PROJECT
Regarding offshore aquaculture in the United States

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Mr. Chairman and members of the committee, thank you for inviting me to testify on the future of offshore aquaculture in the United States. My name is Richard Langan, and I am the director of the University of New Hampshire (UNH) Open Ocean Aquaculture Project. I am honored to have this opportunity to inform you not only about the work of our Project, but also to convey my thoughts on a subject to which I have devoted a good part of my life.

Twenty-five years ago, I was a commercial fisherman in the Gulf of Maine. I worked on a dragger, harvesting groundfish like cod, haddock, and flounder. We fished round the clock for several days at a time, dragging our trawl gear over the seafloor, briefly interrupting our "bottom time" every few hours to bring the catch on deck. One night when I was at the wheel, I looked out the pilothouse window and saw the lights from what must have been at least 50 boats, all doing the same thing as ours—catching as many fish, as fast as they could. It was a life-changing moment. It was clear to me that New England's commercial fisheries could not sustain that level of exploitation, and that there had to be a better way to provide seafood and make a living.

At that time, what we now think of as aquaculture was only a blip on the radar screen of global seafood production. Most of the seafood we consumed came from the commercial fishing of wild stocks. That situation has changed dramatically. Many of New England's marine fish populations crashed in the 1990s, and despite severe restrictions on commercial fishing, they have yet to recover. Commercial fishing and all of its related industries—seafood processing, restaurants, hospitality, tourism—have felt the pressure. Fishing fleets are underutilized, fishermen are under-employed, and prospects for the future are bleak.

Globally, the catch from wild fisheries essentially has remained unchanged since 1984, despite the proliferation of larger, more efficient boats fishing every corner of the world's oceans. At the same time, demand for seafood has been on the rise. As a result, many countries have turned to aquaculture, which now accounts for roughly 40 percent of global seafood production. Here in the U.S., we consume nearly 17 pounds of seafood per person each year, and more than 70 percent of that is imported. The U.S. trade deficit for seafood now exceeds \$8 billion a year, second only to oil as a deficit commodity.

The practice of farming marine fish and shellfish has become part of an international approach to seafood production. Today, U.S. aquaculture takes place almost exclusively in land-based operations or in sheltered, nearshore

waters. There is a limit to what these approaches can produce, particularly in coastal waters that are already crowded by other activities. There is also evidence that some nearshore venues may not be environmentally suitable for large-scale finfish production.

The Need For Offshore Aquaculture

There is growing consensus among many scientists, federal and state marine resource managers, and industry representatives that moving aquaculture offshore could greatly expand our capacity for seafood production and reduce the environmental impacts associated with nearshore aquaculture. It seems shortsighted for the U.S.—in need of a solution to the problem of growing seafood demand and limited supply—not to pursue a sustainable approach to offshore aquaculture. Developed and regulated responsibly, an offshore aquaculture industry could boost the national economy, reduce pressure on commercial fisheries, and provide a secure and healthy food source for the American people.

It has been my privilege to work with a highly talented and environmentally minded team of engineers, fisheries biologists, ecologists, and social scientists at UNH on this very issue. More than a decade ago, this interdisciplinary team recognized that the U.S. was headed for a seafood supply crisis. Understanding the limits of wild fisheries as a resource, and the constraints on the expansion of nearshore aquaculture, we became one of the first groups in the country to develop research programs that explored the feasibility of offshore fish farming.

A few, small-scale plot projects in the mid 1990s yielded encouraging results. This led to the concept of an offshore facility, where researchers could work in cooperation with fishermen and industry partners to develop, test, and demonstrate offshore mooring and cage designs, feeding and communication systems, and cultivate native species from wild broodstock.

University of New Hampshire Open Ocean Aquaculture Project

In 1997, fortunate to have the support of Senator Judd Gregg (R-NH), the UNH team received funding from NOAA to establish the Open Ocean Aquaculture Project. At the Project's inception, our goal was to explore the environmental soundness, technological feasibility, and economic viability of farming finfish and shellfish in exposed ocean environments. To this end, we have combined stringent engineering design, progressive fish husbandry with native broodstock, advanced communications technology, rigorous environmental assessment, and community outreach—all in support of the development of an environmentally-sustainable, offshore aquaculture industry in New England and nationwide.

The heart of this Project is a 30-acre field site, six miles off the coast in New Hampshire State waters. The site is fully permitted by state and federal agencies, just as any commercial venture would have to be. There we raise native finfish species in submersible cages and native shellfish on submerged longlines. All of this takes place in 180 feet of water and is fully exposed to the high-energy environment of the Gulf of Maine. This is where the questions about offshore aquaculture that the Project was created to answer are put to the most rugged of tests. With consistent funding, a dedicated and talented team, and a substantial infrastructure, we have made tremendous strides toward bringing offshore aquaculture closer to commercial reality.

Lessons Learned

After eight years of offshore aquaculture research and development, environmental monitoring, and economic assessment, our research team has reached some conclusions about the viability of offshore aquaculture.

- Finfish and shellfish culture systems (farms) can be installed, maintained, and operated in the harshest oceanic conditions.
- Farm-raised finfish and shellfish can thrive in these conditions. Halibut, haddock, and cod—all of which we have raised in and harvested from offshore cages—demonstrate excellent commercial potential. With further research to improve growth performance, offshore cod and halibut farming could become commercially viable in the near future.
- Remotely controlled feeding and observation systems, which have been greatly advanced by our Project's engineering team, are essential to the success of offshore aquaculture.
- With properly sited farms, appropriate system design, and sound management and husbandry practices, the environmental impacts of offshore finfish culture would be negligible. After six years of farming fish and shellfish at our research site, we did not detect any changes to the water quality, sediment conditions, or biological communities in the vicinity of our field site.
- The offshore mussel culture technology developed by our Project is a clean, sustainable practice and an economic opportunity for fishermen. The first commercial enterprise using this technology (with assistance from our Project) is a small-scale farm licensed to a N.H. fisherman. This farm is projected to generate \$250,000 annually, and we estimate that a modest expansion of this technology in N.H. waters could yield local fishermen \$2 million per year. The area from Cape Ann, Massachusetts, to Cape Elizabeth, Maine could yield as much \$40 million per year.

- Based on conservative estimates of the production value per unit area, applying a very small percentage of the U.S. Exclusive Economic Zone (EEZ) toward aquaculture production would go a long way in closing the gap between domestic seafood supply and demand.

Challenges Ahead

Our research indicates that there is tremendous potential for a commercially viable and environmentally sound offshore aquaculture industry in the U.S. This optimism is supported by the success of commercial operations in Hawaii, Puerto Rico, and abroad. However, we also recognize that for this industry to succeed at a scale that will meet current and future demand, significant technical and operational challenges must be addressed. These include the following.

- *Improve efficiency and safety of operations:* Working on the open ocean is challenging and costly. Offshore farming systems, the vessels that attend them, and related equipment all must be designed with efficiency and worker safety in mind. Currently, routine operations, such as cage maintenance and harvesting, require SCUBA diver support. This is expensive and dangerous, even in the best of circumstances. Alternative approaches for routine operations and a greater level of automation and mechanization must be developed and implemented in the U.S.
- *Minimize fish escapes:* The unintentional release of farmed fish is an economic risk for the farmer and—depending on the genetic makeup of the cultured species—a potential risk to wild fish. The U.S. must continue to develop and refine secure, predator-proof containment systems and management practices that minimize the possibility of fish escape.
- *Mitigate potential resource and user conflicts:* Properly locating an offshore aquaculture farm is the critical first step in insuring its economic success, protecting natural resources, and preventing conflict with other activities. The U.S. must develop and apply a systematic, ecosystems-based approach to identifying optimal aquaculture sites in the EEZ. This approach should employ geospatial technology, ocean observing data, and physical and biological modeling and simulation. This should be coupled with environmental guidelines that minimize potential impact on the ecosystems surrounding these farms.
- *Develop hatchery production capacity:* Where will the juvenile fish that stock offshore farms come from? The answer to this question is a classic “chicken and egg” scenario. The U.S. currently lacks hatchery

capacity to supply even a modest expansion of offshore farms. At the same time, existing marine finfish hatcheries struggle from lack of customers for their fish. A strategy to maintain and enhance hatchery capacity is vital to offshore aquaculture's commercial development.

- *Secure sustainable feed sources:* Aquaculture relies on a steady supply of raw material to formulate fish feed. Marine fish, in particular, require diets high in protein and lipid content. Currently, these nutritional requirements primarily come from fishmeal and fish oil. Aquaculture accounts for only 30 percent of the fishmeal consumed; the rest is fed to poultry and swine. However it is attributed, fishmeal is a finite resource. The U.S. must identify alternative and renewable sources of nutritionally appropriate proteins and lipids in support of a large-scale expansion of marine fish culture.
- *Improve production efficiency:* Successful and profitable offshore aquaculture can only be achieved in conditions that are optimal for the fish. Just as with humans, lower stress equals better health. To develop cages, feeds, and feeding schedules conducive to healthy fish, the U.S. needs a more nuanced understanding of the physiological and behavioral responses of fish to their environment.
- *Identify alternative energy sources:* Everyone is feeling the pressure of rising fuel prices, and potential offshore fish farmers are not an exception. The cost of powering offshore farms will have a tremendous impact on the industry's economic viability. This could be offset by harnessing the tremendous power of ocean wind, waves, and currents.

Need for Public Support of Research and Development

The challenges that face an emerging offshore aquaculture industry underscore the need for a strategic, comprehensive program of basic and applied research, and technology development, demonstration, evaluation and transfer. This, in turn, raises the question of whether such a program should be the responsibility of the private sector or the U.S. government.

Publicly supported research and development has been essential to the creation and continued success of many U.S. industries. This is particularly true for agriculture. Even in industries that generate the most profitable of commodities, private investment only occurs when adequate scientific evidence warrants economic risk. That the U.S. is a world leader in many agricultural sectors is due in large part to public support—for research conducted at universities and government laboratories, and for the network of agriculture experiment stations and farms that apply new technologies and demonstrate their usefulness to farmers.

Research and demonstration, coupled with a well-developed system for technology transfer through the agricultural extension service, is a formula that has served U.S. agriculture remarkably well. Aquaculture, in particular offshore, must adopt a similar approach to guide industry development and insure environmental stewardship.

National Offshore Aquaculture Act of 2005

As it has been proposed, the National Offshore Aquaculture Act offers an excellent regulatory and procedural framework from which the U.S. can build a sustainable, offshore aquaculture industry. What the Act now requires is the input of informed stakeholders.

As a scientist immersed in developing solutions to the technical, social, environmental, and economic hurdles that face offshore aquaculture, I believe that Act should be further developed to authorize a research and development (R&D) program to support and guide this fledgling industry. Independent, scientifically verified R&D will make the difference between a successful industry and a struggling one, between one that harms the environment and one that is engaged in systematic environmental protection.

Such a program would have two components: commercially independent and broadly credible demonstration projects to test the effectiveness of available technology; and competitive, peer-reviewed research funding opportunities to address evolving challenges. This is, effectively, the approach that has made U.S. agriculture the envy of the world—competitive research combined with learning platforms that transfer the fruits of this work directly to those who can apply it to the benefit of the American consumer.

To determine the appropriate levels of federal, state, and industry investment in this program will require careful planning and discussion. However, it is clear that for such an investment to be effective, it must be commensurate with the challenge at hand. What is it worth to the United States to replace an \$8 billion trade deficit with a strong, successful offshore aquaculture industry, one that bolsters the economy and provides a secure source of healthy food? U.S. investments in agricultural technology development and transfer should help us answer that question.

Fortunately, we do not have to start from scratch. The future U.S. offshore aquaculture industry is already supported by NOAA's Sea Grant program, research projects underway at laboratories and universities like UNH, and private sector initiatives. Indeed, last year Congress took a strategic step in leveraging these efforts by appropriating the funds for the UNH Open Ocean Aquaculture Project to become the Atlantic Marine Aquaculture Center. Implicit in this decision is the acknowledgement that while offshore aquaculture is a national issue, it manifests differently at the regional level.

This new center for New England mirrors similar initiatives in the Gulf States and Hawaii. The motivation for these regional centers is a product of local opportunity and need. As such, each plans to work closely with local fishing interests and coastal communities to develop approaches to offshore aquaculture that complement local economies, geography, and culture. At the same time, each will benefit from participating in a national consortium that collaborates to identify bottlenecks to industry advancement, prioritizes research topics, and freely exchanges information and technology.

Closing Statement

It has been nearly one year since National Offshore Aquaculture Act was introduced. In that time, an offshore aquaculture industry in the U.S. EEZ has been described as both a panacea for an impending economic crisis and a serious environmental hazard. As a scientist and a citizen, I do not subscribe to either opinion. The research data from our Project at UNH strongly suggests that there is a bright and sustainable future for offshore aquaculture in this country and that it may help relieve pressure on our fisheries. It also suggests that for that to occur, the U.S. must allocate appropriate investments in related R&D and develop sound regulatory oversight with the input of a range of marine resource stakeholders.

It is clear the world will not wait for us in this matter. Offshore aquaculture is already being developed in the Caribbean, Europe, and Asia. And in some instances, this has been with the benefit of U.S. research and development. I do not believe we should relinquish the fruits of our investments to other nations without first exploring the potential for offshore aquaculture in this country. Nor do I believe that we should rely solely on other nations to develop and regulate an offshore aquaculture industry that will impact the environmental quality of our oceans and the health of U.S. consumers.